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IN THE INTERNATIONAL BUREAU OF WIPO

Applicants:	LAIRD TECHNOLOGIES, INC. et al.
International Application No.:	PCT/US2003/031119
International Filing Date:	2 October 2003
Priority Date Claimed:	3 October 2002
For:	EMI-ABSORBING AIR FILTER

7 June 2004

AMENDMENT UNDER ARTICLE 19

The International Bureau of WIPO
34, chemin des Columbettes
1211 Geneva 20
SWITZERLAND

Sir:

In response to the International Search Report of 7 April 2004 on the above-identified application, the Applicants respectfully submit the following amendments to the claims. Replacement pages for pages 18 through 24 are submitted herewith.

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The Applicants amend claim 1 as follows, where the underlined words are being added, and the struck words are being removed, by the amendment.

1. An air filter having electromagnetic-energy absorptive characteristics, the filter comprising:

a porous substrate; and

an electrically absorptive material ~~applied to the porous substrate, wherein the electrically absorptive material is~~ distributed substantially uniformly through the porous substrate, said electrically absorptive material being an electrical absorber in particulate form suspended in a binding agent.

Claim 2 is being cancelled, as the limitation set forth therein has been incorporated into claim 1 by the amendment above.

Claims 3 and 4 have been amended to depend from claim 1 rather than from the cancelled claim 2.

Claim 5 has been amended as follows:

5. The air filter of claim ~~2~~ 1, wherein the electrically absorptive ~~layer~~ material further comprises a highly conductive material.

Claims 6 through 20 have not been changed by the present amendment.

Claim 21 is being amended as follows:

21. A method for producing an air filter having electromagnetic-energy-absorptive characteristics comprising the steps of:

providing a porous substrate having a first side and a second side; ~~and~~

providing an electrically absorptive solution, said electrically absorptive solution being an electrical absorber in particulate form suspended in a liquid binding agent;

applying ~~an~~ said electrically absorptive solution to the porous substrate~~, wherein the electrically absorptive solution is distributed substantially uniformly through the porous substrate~~;

distributing said electrically absorptive solution substantially uniformly through the porous substrate; and

curing said electrically absorptive solution.

Claim 22 is being amended as follows:

22. The method of claim 21, wherein the applying step comprises the sub-steps of:

~~providing an electrically absorptive solution comprising an electrical absorber and a binding agent;~~

immersing the porous substrate into the electrically absorptive solution, causing the electrically absorptive solution to penetrate the porous substrate;

extracting the immersed porous substrate from the electrically absorptive solution; and

removing excess electrically absorptive solution from the extracted porous substrate, thereby leaving a substantially uniform distribution of electrically absorptive solution through the porous substrate~~; and~~

~~curing the electrically absorptive solution~~.

Claims 23 through 25 have been amended to depend from claim 21, rather than from claim 22.

Claim 26 has not been changed by the present amendment.

Claim 27 has been amended to depend from claim 22, rather than from claim 21.

Claim 28 through 30 have not been changed by the present amendment.

Claim 31 is being amended as follows:

31. The method of claim 21, wherein the applying step comprises:

~~providing an electrically absorptive solution comprising an electrical absorber and a binding agent;~~

spraying the electrically absorptive solution onto the first side of the porous substrate; <u>and</u>

removing excess electrically absorptive solution from the sprayed, porous substrate, thereby leaving a substantially uniform distribution of electrically absorptive solution through the porous substrate~~; and~~

~~curing the electrically absorptive solution~~.

Claims 32 through 36 have not been changed by the present amendment.

REMARKS

The present "Amendment Under Article 19" is being submitted to place the claims in form that is more clear and readily distinguishable from the teachings of prior art cited in the International Search Report, in particular, the three references indicated as belonging to category "X" in that report.

The present claims are directed toward an EMI-absorbing air filter, and to methods for making such an air filter. In brief, the air filter is a porous medium, such as an open-call foam, which is uniformly impregnated with an electrically absorbing material, namely, an electrical absorber in particulate form suspended in a binding agent. In its basic form, the EMI-absorbing air filter is not, as a whole, a conductor of electricity. Rather, the electromagnetic energy falling upon it is absorbed, being changed into other forms, such as heat. The binding agent may be an elastomer, rubber or epoxy, all non-conductors of electricity. The electrical absorbers, for the most part, are also not conductors of electricity.

The three "X" documents, U.S. Patent Application Publication No. US2003/0085050 A1 to Zarganis et al.; U.S. Patent No. 5,506,047 to Hedrick et al.; and U.S. Patent No. 5,431,974 to Pierce, all show conductive air filters.

Specifically, Zarganis shows filters and gaskets made from conductively coated reticulated foam. The coating is applied by such techniques as vacuum deposition, thermal vapor deposition, electroless plating, and sputtering. The metal coating is of conductive metal. The coatings are presumably continuous, so as to make the filter conductive, and no binder is used during the application process or thereafter to attach the coating to the foam.

Similarly, Hedrick shows a porous electrically conductive material used in a filter for electrical equipment. The porous, electrically conductive material may take many forms. Porous media, which are coated by such processes as vapor deposition, sputter coating or electroless chemical deposition processes, are included, but there is no teaching of the use of a binder to attach an electrical absorber in particulate form to the porous media.

Finally, Pierce shows a conductive filter which includes a porous panel of electrically conductive material. The porous panel is rendered electrically conductive by application of metals to their surfaces by metallizing processes such as electroless chemical deposition, electrochemical deposition, vapor deposition, sputter coating, and the like. There is no teaching of the use of a binder to attach an electrical absorber in particulate form to the porous media.

In short, it is submitted that the three "X" category references neither show the EMI-absorbing air filter nor the methods for making same claimed in the present application.

Respectfully submitted,

John F. Gulbin

John F. Gulbin
Registration No. 33,180

212.297.5800

Pitney Hardin LLP
7 Times Square
New York, NY 10036-7311
United States of America

WHAT IS CLAIMED IS:

1. An air filter having electromagnetic-energy absorptive characteristics, the filter comprising:

a porous substrate; and

an electrically absorptive material distributed substantially uniformly through the porous substrate, said electrically absorptive material being an electrical absorber in particulate form suspended in a binding agent.

2. cancelled

3. The air filter of claim 1, wherein the electrical absorber is selected from the group consisting of carbon, carbon particles, carbon fibers, alumina, sapphire, silica, titanium dioxide, ferrite, iron, iron silicide, graphite, and composites of iron, nickel and copper.

4. The air filter of claim 1, wherein the binding agent is selected from the group consisting of an elastomer, a rubber and an epoxy.

5. The air filter of claim 1, wherein the electrically absorptive material further comprises a highly conductive material.

6. The air filter of claim 5, wherein the highly conductive material is selected from the group consisting of copper and aluminum.

7. The air filter of claim 1, further comprising a fire-retardant layer.

8. The air filter of claim 7, wherein the fire-retardant layer comprises a fire retardant selected from the group consisting of phosphates and antimony trioxide.

9. The air filter of claim 7, wherein the fire-retardant-treated porous substrate passes a self-extinguishing vertical burn requirement in accordance with Underwriters Laboratories Standard 94.

10. The air filter of claim 1, wherein the porous substrate comprises an open-cell reticulated polyurethane foam.

11. The air filter of claim 10, wherein the foam comprises at least about 10 pores per linear inch.

12. The air filter of claim 1, wherein the porous substrate comprises a fiberglass mat.

13. The air filter of claim 1, wherein the porous substrate comprises a non-woven polyester web.

14. The air filter of claim 1, further comprising an electrically conductive layer.

15. The air filter of claim 14, wherein said electrically conductive layer is an electrical conductor having an array of apertures through which air can flow.

16. The air filter of claim 14, wherein said electrically conductive layer is a conductive coating applied thereto.

17. The air filter of claim 14, wherein the electrically conductive layer comprises a honeycomb.

18. The air filter of claim 1, further comprising a frame fixedly attached to the porous substrate, wherein the frame provides physical support for the porous substrate.

19. The air filter of claim 1, wherein the porous substrate comprises a sheet having a thickness less than about 0.5 inches.

20. The air filter of claim 1, wherein the porous substrate provides at least 20 dB of attenuation to electromagnetic energy substantially occurring at frequencies at least between about 4 GHz and 18 GHz.

21. A method for producing an air filter having electromagnetic-energy-absorptive

characteristics comprising the steps of:

providing a porous substrate having a first side and a second side;

providing an electrically absorptive solution, said electrically absorptive solution being an electrical absorber in particulate form suspended in a liquid binding agent;

applying said electrically absorptive solution to the porous substrate;

distributing said electrically absorptive solution substantially uniformly through the porous substrate; and

curing said electrically absorptive solution.

22. The method of claim 21, wherein the applying step comprises the sub-steps of:

immersing the porous substrate into the electrically absorptive solution, causing the electrically absorptive solution to penetrate the porous substrate;

extracting the immersed porous substrate from the electrically absorptive solution; and

removing excess electrically absorptive solution from the extracted porous substrate, thereby leaving a substantially uniform distribution of electrically absorptive solution through the porous substrate.

23. The method of claim 21, wherein the electrical absorber is selected from the group consisting of carbon, carbon particles, carbon fibers, alumina, sapphire, silica, titanium dioxide, ferrite, iron, iron silicide, graphite, and composites of iron, nickel and copper.

24. The method of claim 21, wherein the binding agent is selected from the group consisting of an elastomer, a rubber and an epoxy.

25. The method of claim 21, further comprising the step of forcing air through the porous material during at least one of prior to curing and curing, thereby ensuring that pores remain substantially unblocked.

26. The method of claim 25, wherein the step of forcing air through the porous material comprises drawing a vacuum.

27. The method of claim 22, wherein the step of removing excess electrically absorptive solution comprises squeezing the extracted porous substrate.

28. The method of claim 21, wherein the step of applying an electrically absorptive solution is repeated.

29. The method of claim 21, further comprising the step of applying a fire-retardant layer.

30. The method of claim 29, wherein the fire-retardant layer comprises a fire retardant selected from the group consisting of phosphates and antimony trioxide.

31. The method of claim 21, wherein the applying step comprises:

spraying the electrically absorptive solution onto the first side of the porous substrate; and

removing excess electrically absorptive solution from the sprayed, porous substrate, thereby leaving a substantially uniform distribution of electrically absorptive solution through the porous substrate.

32. The method of claim 31, further comprising the step of spraying the electrically absorptive solution onto the second side of the porous substrate.

33. The method of claim 21, wherein the air-flow characteristics of the porous substrate are substantially equivalent before and after the application of the electrically absorptive solution.

34. The method of claim 21, wherein a reduction in air-flow capacity of the porous substrate when compared before and after the application of the electrically absorptive solution is preferably less than 25%.

35. The method of claim 21, wherein a reduction in air-flow capacity of the porous substrate when compared before and after the application of the electrically absorptive solution is more preferably less than 15%.

36. The method of claim 21, wherein a reduction in air-flow capacity of the porous

substrate when compared before and after the application of the electrically absorptive solution is even more preferably less than 10%.